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Keeping it in the ground? Assessing global governance for fossil-fuel supply reduction

Tim Rayner*Tyndall Centre for Climate Change Research, University of East Anglia, School of Environmental Sciences, Norwich Research Park, Norwich, NR4 7TJ, United Kingdom*

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ABSTRACT

Restricting the international supply of fossil fuels is increasingly acknowledged as a necessary part of achieving long-term global temperature goals. However, the barriers to imposing such restrictions are immense. Issues of economic stability, equity, and associated geo-political tensions, are particularly acute. In theory, a managed decline can be facilitated by international cooperation. In practice, however, despite some apparent rhetorical commitments, adequate institutional responses have not been forthcoming. This paper highlights potentially relevant institutions, and assesses their combined contribution to fulfilling a set of governance functions relevant to decarbonisation in this case. The analysis finds that the governance challenges associated with deciding what fossil fuel carbon should be designated 'un-burnable', and managing the associated equity-related, geo-political conflicts, are far from being fully recognised. Potential institutional reforms, by which governance gaps could be narrowed, are identified. These highlight the further potential of the G20, UNFCCC and WTO in particular.

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1. Introduction

A carbon 'budget' compatible with limiting global average temperature rise to 2 °C (let alone 1.5 °C) is widely acknowledged to require most global fossil fuel reserves to remain 'in the ground' (Rogelj et al., 2018); a third of oil, half of gas and over 80% of coal reserves, by one calculation (McGlade and Ekins, 2015). A 1.5 °C pathway requires investment in fossil-fuel extraction and conversion to decrease by around a quarter over two decades (Rogelj et al., 2018, para 2.5.2). Between 2000 and 2014, however, such investment more than tripled, and remains the largest share of world energy investment (IEA, 2016). Despite recent growth in renewable energy, fossil fuel use is also projected to grow (IEA, 2018). A 'wicked' combination of social, political, institutional, and economic factors lies behind an on-going lock-in of fossil fuel-intensive investment. In developing countries with large unmet energy needs especially, but also in developed economies where fossil-fuel-oriented multinationals generate significant wealth, extraction and trade are widely considered central to energy security and economic development.

Given this context, climate policy at all levels, not least the international, has focussed almost exclusively on curtailing demand

for fossil fuel energy (and associated emissions), neglecting potential interventions on the *supply-side* that would limit exploration, extraction or transportation. It is increasingly recognised, however, that effective action requires attention to both sides (Green and Denniss, 2018), including reduction of generous production subsidies, which at current levels would lead to over 37 Gt CO₂ being emitted between 2017 and 2050 that would otherwise not occur (Gerasimchuk et al., 2017).

This selective policy attention notwithstanding, producing and exporting countries and companies are beginning to experience pressure to change from various sources, not necessarily policy-related. As energy efficiency measures, substitution, and lower cost low-carbon technologies take effect, falling demand for fossil fuel in many regions is set to continue (IEA, 2018). The resulting decline in oil prices has encouraged economic diversification by producers (Tagliapietra, 2017). Investors uncertain of long-term viability, especially if climate policy tightens, are demanding higher returns before committing to long-cycle oil and gas projects (OIES, 2019). Shareholder activism, the divestment movement and climate-oriented legal actions represent further and growing challenges with potential to prompt diversification by energy majors or steps to return money to shareholders. A small number of national and sub-national governments have introduced restrictions on exploration or extraction within their jurisdictions

E-mail address: tim.rayner@uea.ac.uk.

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(Erickson et al., 2018), and/or reduced levels of subsidy (Skovgaard and van Asselt, 2018).

Supply-side climate policy is now attracting increased attention from scholars, policy makers and activists alike. The relevance and potential role of international governance institutions are being examined in a small but growing literature (see e.g. Asheim et al., 2019; Piggot et al., 2017; Van Asselt, 2014; Van Asselt and Kulovesi, 2017; Verkuil et al., 2018). This literature notes how deference to national sovereignty concerns and perceived national interests causes relevant governance institutions to steer clear of the supply-side agenda. While unlikely to change greatly in the near term, it is important to understand better the underlying dynamics and constraints, and begin to contemplate appropriate international-level policy responses.

Against this backdrop, this paper assesses the potential of international governance institutions to contribute to 'supply-side' climate policy, managing the decline of fossil fuel production, and the extent to which it is being utilized. It does so by applying the framework for sectoral system analysis developed in the introductory paper to this issue in which international institutions are understood as establishing substantive rules and norms that can prescribe, proscribe, permit or direct relevant behaviour of state and non-state actors, and to entail procedural rules for making and implementing related decisions (Oberthür et al. a, this issue). Transnational institutions are run exclusively by non-state actors, while hybrids include both non-state and state actors/governments. To be included, institutions should either have climate mitigation as an explicit goal, or pursue goals and activities that significantly facilitate or impede mitigation efforts.

Because both extraction and current consumption levels are so heavily reliant on subsidies, and opportunities to reduce these are increasingly discussed, attention is given to subsidy reform. With limited space, most consideration is given to oil and especially coal, the most carbon-intensive fossil fuels, reduction in supply of which is widely considered most urgent. In terms of the governance landscape, a series of bilateral and regional economic agreements have some relevance to energy-related decisions, but are not discussed in detail. Although fugitive emissions from production are far from trivial, and an interesting sub-set of related transnational or hybrid institutions has emerged to address them, here the problem is assumed to recede once supply constraints take effect.

The paper is structured as follows. In section 2, the transformation challenges and governance needs applying to the fossil fuels extractive sector are set out, highlighting what needs to change to deliver decarbonisation, and key barriers to those changes. The potential benefits, in principle, of international cooperation are set out. Potentially relevant institutions/initiatives are then presented in section 3, followed by an assessment of their combined effects on fulfilment of key governance functions in section 4. Potential options for reform involving a range of institutions are sketched in section 5, and an outlook offered.

2. Transformation challenges and governance needs

2.1. Daunting barriers

The fossil fuel extractive 'sectoral system' presents a unique challenge, in that climate policy imperatives require its virtual elimination; while not without potential, carbon capture and storage technologies cannot be deployed quickly enough at sufficient scale. From this over-arching, fundamental challenge arise two more specific challenges. Firstly, acceptable processes/rules through which the timing and sequencing of production phase-outs can be agreed (including which fossil fuels to prioritise, from which locations, and

whether compensation is appropriate) need to be devised. Secondly, a range of 'lock-ins' (political, institutional, economic, social) that perpetuate fossil fuel-reliance and, to varying degrees, shut off alternative development paths (Seto et al., 2016), must be tackled. Some, though by no means all, could be loosened through international-level governance interventions, even if only indirectly.

Regarding the phase-out schedule, decisions could be informed by either efficiency or fairness principles, or some combination of these. Prioritising economic efficiency would see continued exploitation of the least greenhouse gas-, capital-, or resource-intensive resources, while others remain untouched (see McGlade and Ekins, 2015). High carbon content, relative ease of substitution and relative lack of export value suggest that action on coal should be most rapid. Under a least-cost strategy, OECD countries would implement a complete phase out by 2030, China (the biggest coal producer and user) by 2040 (Climate Analytics, 2016). For oil, it may be efficient for exploration and production to continue in lower-cost areas (Manley et al., 2017; Tagliapietra, 2017). While low-income countries may benefit from this, oil rents are still likely to decline significantly due to falling prices associated with reductions in demand (Manley et al., 2017).

Whether those foregoing extraction should be compensated, and on what basis, is debatable, given that reduced production may result from multiple causes (Lenferna, 2018). But a production phase-out process not perceived as equitable will surely meet resistance. Currently, over half of least developed and lowest income countries are planning either further exploration or expansion of existing production (Bradley et al., 2018). Those with abundant reserves but slow extraction rates risk the 'stranding' of much hydrocarbon wealth in the event that demand peaks and declines in the relatively short term.

A more equitable approach could take inspiration from the UNFCCC principle of 'common but differentiated responsibility and respective capabilities', giving greater production rights to the poorest, who have extracted and benefited least to date, and have fewest alternative means of development (Caney, 2016). The trillions in 'foregone rents' at stake constitute a substantial share of the GDP of many countries (Kantha et al., 2016). Such rents are unevenly distributed among countries, and also regions and individual economic entities. That some stand to lose much more from supply-side restrictions constitutes a huge challenge to multi-lateral efforts, requiring reductions to be planned and managed over extended periods, with alternative economic paradigms developed for fossil-fuel-dependent regions.

As noted above, a range of 'lock-ins' militate against supply reductions. Arguably the most important relate to the reliance of many states on fossil fuels for their fiscal sustainability. Inability to sustain domestic spending commitments would threaten political legitimacy and stability in many cases. To transcend their current status as 'rentiers', to become more economically diverse 'production states', Middle Eastern and North African (MENA) oil exporters, for example, must overhaul entire economic, social and political models – even as they undergo significant demographic change (Tagliapietra, 2017).

In contrast to private companies which can in principle diversify or return money to shareholders, countries have considerably less flexibility to redeploy capital. Governments own over 50% of global fossil fuel production (80–90% of proven oil reserves) through majority-stakes in, or fully nationalised, producing companies (Whitley and van der Berg, 2015). These cannot be sold outright but only licensed to companies for development (Manley et al., 2017). For developed countries, the likelihood of 'stranded' assets raises public policy concerns about financial instability and a growing pension deficit.

At the time of this writing (late 2019), concerns about a carbon asset 'bubble' do not appear to have diffused especially widely.¹ One recent analysis warns of potential discounted global wealth loss of \$1–4 trillion – comparable to what triggered the 2007 financial crisis (Mercure et al., 2018). Lack of awareness or even willful blindness on the part of policy makers and stakeholders to the prospect of key assets becoming stranded – potentially by technological changes even without tighter climate policy – and the momentous economic consequences, may be regarded as key barriers to contemplating a phase-down. This is reinforced by politically powerful producer groups who, in the absence of countervailing lobbies (Asmelash, 2017), secure preferential treatment from national governments – and significant influence over international negotiations (Corporate Accountability International, 2017). Government support includes subsidies to production, ranging from direct payments, preferential access rights to energy deposits, credit and insurance support, caps on liabilities, government ownership of power generation (Koplow and Charles, 2010). High shares for fossil energy have been sustained, even with falling cost of renewables, in part by a 50% increase in subsidies from 2008 to 2018 (Climate Transparency, 2018). Estimating their full extent is complicated, in part due to substantial data gaps because of limited government transparency, partly to lack of consensus over what constitutes subsidy. A full accounting of global energy subsidies (for all types) has never been completed.²

In addition to heavy corporate influence, policy makers may also experience pressure from civil society and trade unions from regions whose well-being is particularly dependent on fossil fuel extractive industries, concerned with the social justice implications of any 'phase out'. But even if political will and a degree of societal/stakeholder acceptance could be mustered, governments may still be impeded by a lack of bureaucratic capacity to conceive of alternative development paths (including reforms to subsidies). Investors, moreover, may be unwilling to invest in other sectors.

2.2. Promise and potential of international cooperation

Supply-side climate policies cover, *inter alia*, extraction taxes, subsidy reform, moratoria or quotas, or a reduced extraction from public lands (Green and Dennis, 2018). The economic theory informing much supply-side policy discourse suggests that countries cooperating to cut emissions can enhance their effectiveness by cutting production as well as demand for fossil fuels (ibid 2018). Without such steps, free riders in terms of mitigation effort will benefit from cheaper fossil fuels, as market price adjusts to a lowering of overall demand, causing cross-border 'carbon leakage'. Moreover, producers would likely accelerate extraction to secure rents before demand falls significantly (the 'green paradox'). While national governments guard their right to govern fossil fuel development and any related transition, international institutions can nevertheless, at least in principle, influence behaviour, constrain activity, and shape expectations in potentially helpful ways (Van Asselt, 2014). By fostering greater transparency and learning, for example, some of the lock-ins noted above could be loosened, particularly related to subsidies. International institutions may be able to ease geo-political tensions provoked by radical supply-side interventions.

This section explores the potential for international cooperation, in terms of the importance and potential of five international governance functions, as summarised in Table 1, in relation to the challenges and barriers identified above.

The assessment is summarised in Table 2.

Guidance and signal

A consensual and deliberate phasing out of fossil fuel extractive industries requires a common understanding of its necessity and urgency. There is a clear need to signal at international level the resolve of governments and others to pursue the reduction and eventual elimination of fossil fuel production and, as part of that, the subsidies underpinning much 'business as usual'. Ideally, deadlines should be attached. Such international signals will strengthen the 'social license' for governments (national and sub-national) to act (Erickson et al., 2018). Otherwise, governments, businesses, investors and insurers will continue to support unsustainable, but profitable, practices.

A strong case can also be made that some form of international mechanism is needed to share information about carbon-related investment risk. Informed planning by investors and coordinated efforts to safely deflate the global carbon bubble (Mercure et al., 2018) require that the chances (and possible timescale) of assets losing their worth are clearly signalled. A strong international-level signal would also help create opportunities, at multiple levels, to think constructively about the structural changes necessary in regions affected by production cuts (see also 'Learning and knowledge' below).

Setting rules to facilitate collective action

Although voluntary/unilateral initiatives may continue to emerge, only international-level rules will ensure that supply-side controls reach a meaningful scale. As noted above, consensual rules covering timing and sequencing, and the appropriateness of international compensation, are required. Such consequential discussions over which resources should remain 'in the ground', and associated questions of fairness, can only legitimately be held at international level. Without this, less predictable, market-driven changes will likely have de-stabilising effects.

Ideally, targets for extraction of remaining fossil fuels would be set and implemented through a global instrument, or instruments, recognised as equitable. Some commentators have discussed the potential for a global-level moratorium on new coalmines (Blondeel and van der Graaf, 2018), or fossil fuel 'non-proliferation' treaties to phase out the trade in coal (Newell and Simms, 2019). A global system to allocate the bulk of GHG production rights by regular global auction, as close as practical to the point of fossil-fuel production, has been suggested (Tickell, 2009), potentially raising up to €1 trillion per year for climate-related spending.

Regarding fossil-fuel subsidies (FFS), even though reform is more likely to be triggered by domestic economic and fiscal motivations, international-level action could strengthen incentives (Van Asselt and Kulovesi, 2017), and deter renegeing on any voluntary/unilateral commitments (Asmelash, 2017). Stronger agreed definitions of what actually constitutes FFS could pre-empt government denials that they even exist, and put international institutions in a better position to help address them. Explicit, specific commitments should ideally be set out country-by-country, with certain subsidies banned or subject to limits (ibid: 359). However, progress through peer pressure exerted through international organisations is more feasible (Smith and Urpeleinen, 2017).

Transparency and accountability

Any enhanced global regulation of extraction (or subsidy thereof) would clearly require adequate monitoring and

¹ As noted by contributors to the 2018 Fossil Fuel Supply and Climate Policy Oxford conference, for example, the discourse is dominated by 'Northern' voices.

² According to one estimate, fossil fuel subsidies (production and consumption) amounted to US\$493 billion in 2014 (up from US\$300 billion in 2009); renewable energy receives less than a quarter (IEA, 2015). Major economies' subsidies for exploration and extraction may be as high as \$70bn annually (Bast et al., 2015).

Table 1
Overview of main functions of international governance institutions.

Functions	Key features	Main added value
Guidance & Signal	<ul style="list-style-type: none"> Results from overall agreement, including targets/ objectives 	<ul style="list-style-type: none"> Aligns actors across countries
Setting Rules	<ul style="list-style-type: none"> Various forms of obligations and standards 	<ul style="list-style-type: none"> Enables action by addressing interdependence & competitiveness concerns
Transparency & Accountability	<ul style="list-style-type: none"> Reporting, review/verification, compliance 	<ul style="list-style-type: none"> Contributes to effective reciprocity and implementation (addressing free riding) & mutual trust
Means of Implementation	<ul style="list-style-type: none"> Capacity building, technology transfer and finance (North-South) 	<ul style="list-style-type: none"> Facilitates pooling of donors/investors' resources and reducing transaction costs
Knowledge & Learning	<ul style="list-style-type: none"> Generation and collective appraisal of information/ knowledge Science and policy learning 	<ul style="list-style-type: none"> Improved and shared understanding (authoritative knowledge) Improved policies (learning)

Source: Oberthür et al. (this issue).

Table 2
International governance requirements by function.

FUNCTION	Guidance and Signal	Setting Rules	Transparency and Accountability	Means of Implementation	Knowledge and Learning
Importance	High	High	Medium High (FFS reform)	Medium-High	High
Detail of need	<ul style="list-style-type: none"> Signal phase out of fossil fuel extraction – to be completed ASAP after 2050 Signal phase out of fossil fuel subsidies by firm deadline Share information about climate-related investment risk Create opportunities to consider how to embark on structural change 	<ul style="list-style-type: none"> Global regulation of extraction rights/timing and sequencing of phase-out Compensatory measures for developing countries, where deemed appropriate Define what constitutes FFS Rules on FFS phase down/ out 	<ul style="list-style-type: none"> Global regulation requires monitoring/verifying implementation (but activities possess relatively high intrinsic transparency). Internationally comparable (FFS) data to facilitate learning and evaluation of progress, creating peer pressure, enable comparisons. 	<ul style="list-style-type: none"> Technical and financial support for national reform efforts (transition away from extractive industry, FFS reform efforts) 	<ul style="list-style-type: none"> To raise awareness of carbon bubble/stranded asset risk Enhance policy learning r.e. damaging effects of existing practices, benefits of alternative development paths.

Source: author's compilation. Unless otherwise stated, the strength of need is the same for the broader issue of phasing down extractive industries and for FFS reform.

verification. Given the nature of the extractive industries, technically this would not be difficult. In the current context, the issue is most pressing for FFS reform efforts. While domestic reforms can proceed without it, internationally comparable data can facilitate valuable lesson learning and evaluation, creating peer pressure and enabling comparisons of the effectiveness of different interventions (Whitley and van der Burg, 2015) (cf. the knowledge and learning function). It can also bring favouritism towards particular groups to the attention of potential countervailing lobbies, spurring national-level reforms. Mandatory reporting (following the WTO agriculture example) is conceivable in principle. Action on transparency can also be widened and strengthened if progressive governments insist on inclusion of subsidy reform in (bilateral or multilateral) trade agreements (ibid).

Capacity building, technology and finance (means of implementation)

Whilst many rich producers have the capacity to engineer their own transformations (should domestic social/political conditions allow), for many countries ambitious transitions away from reliance on extractive industries will require significant technical and financial support from the international level. The current lack of investment in the private sectors of MENA countries, for example, could be remedied by more strategic investment by sovereign wealth funds (Tagliapietra, 2017). This could benefit from international-level coordination. Conceivably, funds generated by the kind of revenue-raising systems mentioned above could be allocated to this function. Countries could also be supported in boosting analytical capacity within their bureaucracies to conceive of and chart alternative development paths (backed by credible, strong international 'guidance and signal' - see above). Similarly, there is a strong need for technical and financial support from the

international level in terms of enabling FFS reform (Whitley and van der Burg, 2015).

Knowledge and learning

As noted above, lack of awareness of the threat of stranded assets and the benefits that may be associated with radical new development pathways acts as a serious impediment to action. Increasing such awareness may be regarded as a critical early priority for international efforts. Producing knowledge that is widely recognised as legitimate is a major source of influence for international organisations (Van der Graaf and Westphal, 2011). There is a strong case for the involvement of international-level institutions in stimulating relevant (cross-national) learning processes in national institutions that may otherwise lack analytical capacity and continue to assume that fossil fuel extraction furthers development goals, despite evident environmental, social and political side-effects. Learning regarding these side-effects could potentially also be promoted through internationally mandated impact assessments (Healy et al., 2019). In time, such learning could shift engrained perceptions of the 'national interest'. New knowledge about FFS, particularly regarding environmental and socioeconomic effects, could allow reform to be framed as a means to release resources for alternative purposes (Skovgaard and van Asselt, 2018).

3. Governance supply

A wide array of international governance institutions influence the behaviour of state and non-state actors regarding extraction, and of governments in terms of production subsidies. A single, dominant institution, however, is lacking. The most relevant institutions were identified by reviewing established databases and

(grey) literature. In the following, the principal intergovernmental/international organisations are described, before a number of transnational/hybrid initiatives are touched on. The results are summarised in (see online [supplemental material](#)).

3.1. Intergovernmental/international organisations (IOs) and fora

Given the political sensitivities noted in previous sections, the UNFCCC approaches fossil-fuel supply issues only obliquely. Article 4.8, however (covering adverse effects of response measures), mentions 'countries whose economies are highly dependent on income generated from the production, processing and export, and/or on consumption of fossil fuels and associated energy-intensive products' as one type of actor potentially adversely affected by 'response measures' that target carbon emissions. It notes funding and technology transfer as potential actions to meet these countries' specific needs.

The Paris Agreement (PA) (UNFCCC, 2015a) makes no mention of fossil fuels, leaving states to develop policies and measures tailored to national circumstances. For reasons elaborated below, however, it is possible to interpret the mandates of both the UNFCCC and PA as encompassing fossil fuel supply (Piggot et al., 2017). Moreover, COP21 adopted a work programme on the impact of response measures comprising: (1) economic diversification and transformation; and (2) just transition of the workforce, and the creation of decent work and quality jobs (Decision 11/CP.21, paragraph 5).

For its part, the Intergovernmental Panel on Climate Change (IPCC) contributes especially to the knowledge and learning function, facilitating assessments of 'unburnable' carbon. Also at UN level are the Sustainable Development Goals (SDGs), Goal 7 of which highlights access to affordable, reliable, sustainable, and modern energy, Goal 12 responsible production and consumption, and Goal 13 tackling climate change (though without mentioning fossil fuel production explicitly).

Several IOs, including the International Energy Agency (IEA), the International Energy Forum, OPEC, the Gas Exporting Countries Forum and the Energy Charter Treaty, bring together energy producers and consumers in various configurations (Van Asselt, 2014).³

Along with other multilateral development banks (MDBs) and export credit agencies, the World Bank Group (WBG) potentially has an important direct role by either financing fossil fuel (extraction) projects or choosing not to. The WTO remains the only multilateral organisation to administer a legally binding agreement on subsidies. Its disciplines on subsidies, and in particular the WTO Agreement on Subsidies and Countervailing Measures (SCM), are relevant.

Given the unwillingness to transfer substantial authority over energy issues to formal multilateral settings, informal and high-level forums, the G7 and G20 play a major role, ensuring continuous dialogue and deliberation (Van der Graaf and Westphal, 2011). Both have committed to reduce FFS. The G20 (2009) commitment to phasing out 'inefficient' FFS (while protecting the most vulnerable) and encouraging related national strategies inspired a subsequent, regional-level agreement by the Asia Pacific Economic Cooperation (APEC). Moreover, the G20 gave the OECD and IEA a specific mandate (along with OPEC and the World Bank) to research the scale and impacts of FFS as well as experiences with reform. Along with the International Monetary Fund (IMF), the OECD and IEA are among the IOs most concerned with reducing FFS.

3.2. Transnational/hybrid initiatives

An emerging field of NGO/civil society initiatives should be noted, including the [Lofoten Declaration \(2017\)](#), demanding an organised withdrawal from fossil fuel production under the leadership of, and with dedicated support from, high-income producing countries. While contributing to the 'guidance and signal' function, their lack of formalised processes for rule setting mean that such initiatives do not count as international governance institutions for current purposes. On the other hand, the Global Subsidies Initiative (GSI), although a vehicle for NGOs, merits inclusion in this analysis owing to its role providing targeted support, working with countries to implement reforms, and tracking G20 and APEC countries' commitments in phasing out inefficient FFS (Lemphers et al., 2018).

Also noteworthy is the Powering Past Coal Alliance (PPCA), launched by a hybrid mix of state and non-state actors (Government of Canada, 2017). Whilst not strictly targeting extraction *per se*, the Alliance's commitment to abandon coal power-related investments has signalled that investments in continuing production may be unwise.

4. Assessing the governance complex

This section draws together evidence as to how well the set of governance needs and potentials, summarised in [Table 2](#), is being met by current governance arrangements.

Guidance and signal

Norms against continuing use (and, by extension, extraction) of fossil fuels are strengthening and finding expression in a range of fora. G7 countries' widely reported pledge to end all fossil fuel use by the end of the century (Connolly, 2015), for example, appears striking. With its ambitious long-term temperature targets, the PA essentially amounts to the same commitment (Piggot et al., 2017). However, the G7 has never signalled unambiguously any intent to eliminate all fossil-fuel use, while the PA fails to mention fossil fuels at all. Fossil fuel supply is not an explicit part of UNFCCC guidance on developing Nationally Determined Contributions (NDCs); neither are supply-side strategies a separate category in NDC synthesis reports. This enables producers to remain 'strategically ignorant' about the type and pace of change necessary (Piggot et al., 2017: 9). The territorial approach followed by UNFCCC and IPCC in their guidance on inventories is also problematic in failing to recognise actions (such as restricting fossil fuel exports) that might have an effect beyond a country's jurisdiction.

For its part, from as early as 2013 the IEA (and OECD) have issued warnings related to 'unburnable carbon' in annual *World Energy Outlooks* (see e.g. IEA, 2013). However, the Agency's main description of the future (until 2019 referred to as the 'New Policies Scenario' - NPS), treated by energy decision-makers as the most likely outcome and informing myriad investment decisions, implies up to 3.3 °C of warming. In citing it to justify national investments decisions (e.g. in Australian coal basins), decision makers risk rendering this a self-fulfilling prophecy. Only latterly has the IEA bowed to pressure and agreed to develop 1.5 °C-compatible scenarios, and attach 'health warnings' to the NPS (McKinnon, 2019).

More positively, MDBs have begun highlighting the implications of the PA in their contacts with emerging economy governments dependent on fossil-fuel extractive industries.⁴ The Agreement is therefore offering a signal of sorts, one that appears to be stronger

³ The Energy Charter Treaty is designed to facilitate investments and trade in energy among around 50 Eurasian exporter and importer signatories.

⁴ EBRD representative at Fossil Fuel Supply Oxford conference, Sept 2018.

than any offered by the SDGs.⁵ Recent investment policy-related announcements from the World Bank (2017), the European Investment Bank (2019) and PPCA evidence a strengthening in anti-fossil fuel norms. Citing temperature goals, the WBG has made a series of significant decisions, including an end to finance for upstream oil and gas projects after 2019. This built on previous commitments to restrict public finance for coal projects. Less positively, concerns have grown about the chilling signal sent by the Energy Charter Treaty, the investor-state dispute settlement provisions of which mean that corporations can potentially sue governments for 'loss of future profits' (Eberhardt et al., 2018).

For FFS, guidance and signal is present in the aggregate of institutions and initiatives identified, but less definitively than it might be. Specifically, the G20's 2009 compromise to target 'inefficient' FFSs - echoed by the G7 (2016) - allows countries to define the term narrowly; eight members deny operating such subsidies (Asmelash, 2017) (see *setting rules* below).⁶ But following pressure from the Friends of Fossil Fuel Subsidy Reform - a coalition of 9 states calling for the elimination of FFSs for climate policy reasons - the signals emanating from the WTO have strengthened somewhat since 2015. A Ministerial Statement advocating FFS reform has been accepted (WTO, 2017). The (on-going) development of indicators for the UNSDG Goal 12.c.1, which requires tracking of the 'Amount of fossil fuel subsidies per unit of GDP (production and consumption) and as a proportion of total national expenditure on fossil fuels' adds further to the signal.

In terms of the need to share information about climate-related investment risk, the G20's Task Force on Climate Related Financial Disclosures has been in operation since 2015, but is essentially *ad hoc* at time of this writing.

Overall, where the need for this function is high, the signal offered by the governance complex as a whole, while strengthening remains relatively weak, comprising either *indirect* signals (the PA objectives and targets) or partial ones (PPCA, initiatives by MDBs).

Rules to facilitate collective action

Global regulation of extraction rights, and the timing and sequencing of their phase-out, are conspicuously absent from the current regime complex. At best, the UNFCCC/PA offer a permissive architecture within which governments can act and receive corresponding recognition. For example, GHG reduction policies could be accompanied by plans to reduce fossil fuel production, expressed quantitatively through NDCs or Long-Term Low-Greenhouse Gas Emission Development Strategies (LTS). Countries could identify specific policy options, including removal of subsidies.

In terms of the need to consider equity (and specifically the issue of compensatory measures), no effort is currently being made to decide on whether and when financial transfers might be justified, let alone providing for them. The Yasuni ITT initiative, under which Ecuador asked for compensation for abstaining from oil extraction in portions of a national park, failed to generate the requested funding, while a related proposal for a 'net avoided emissions' market mechanism under the UNFCCC did not find favour either (Sovacool and Scarpaci, 2016).⁷ The UNFCCC's (improved) forum on the 'impact of the implementation of response measures' remains essentially a platform in which related challenges can be discussed, but not necessarily resolved (UNFCCC,

2015b); its record on delivering, *inter alia*, support for limiting the adverse impact on developing countries, has drawn criticism (FCCC/SB/2018/INF.4). For the time being, therefore, the activities in this context are best viewed as contributing to the capacity building/means of implementation (and learning) functions (see below).

A shortcoming of intergovernmental agreements to eliminate FFSs has been the lack of clear-cut commitments, including to precise definitions (UNEP, 2019). As well as non-binding, commitments have been vague and indefinite (although the G7 (2016) has pledged to phase out 'inefficient' subsidies by 2025). No specific bans or quantitative limits are in place. Furthermore, potentially applicable WTO rules have not been invoked, and subsidies for fossil fuel consumption and production have barely been raised in that venue. Existing rules of the SCM Agreement appear to be inadequate (Van Asselt, 2014). For a mixture of legal and political reasons, no fossil-fuel subsidy has yet been challenged, and notification rates have generally been low (Casier et al., 2014; Van Asselt, 2014).

In sum, governance needs in this case are only weakly met; what rules there are tend to be permissive and voluntary, rather than mandatory. Urgently needed international rules to reduce the supply of fossil fuels, and manage the distributional conflicts that this would entail, are a long way from being negotiated, or indeed even reaching the agenda.

Transparency and accountability

Given the absence of production-limiting rules, mechanisms to ensure their transparent implementation are similarly absent. What international institutions *have* managed to do is publish estimates of the scale of extraction. However, it would seem reasonable to expect some institutional response to the need to ensure the publication of more internationally comparable data indicating the extent of FFS, and evaluation of how far commitments to reduce subsidies are implemented.

On this, voluntary peer reviews conducted under G20 and APEC auspices identify countries' 'inefficient' FFS. So far, the US, China, Germany and Mexico have undergone this process. In themselves, however, such mechanisms are unlikely to be sufficient to improve transparency (Casier et al., 2014). Greater collaboration between the OECD and the IEA has, however, enhanced transparency and learning on the issue. For the first time, figures from these key IOs have been combined (OECD, 2018), to suggest that FFS totalled at least \$373bn globally in 2015, and that while some developing countries achieved reductions, developed country efforts have slowed. Gaps in this OECD analysis remain, however, e.g. on credit support. Moreover, more attention continues to be paid to *consumer* rather than *producer* subsidies (Van Asselt, 2014). GSI's assistance in tracking progress on G20 and APEC countries' commitments through a dedicated website is significant. Furthermore, adoption of SDG indicator 12.c.1 requiring the tracking of fossil fuel subsidies represents progress.

Overall, while delivery of this function (specifically for FFS) is improving, it remains inadequate.

Means of implementation

Beyond rhetorical commitments, the extent to which international institutions are willing to support significant economic transformations by fossil-fuel producer countries is not easily determined. While the Global Environment Facility (GEF) and the Green Climate Fund (GCF) operate to a general remit of supporting decarbonisation (the former receiving mention in Article 4.8-related decisions), no fund dedicated specifically to managed decline of fossil-fuel extractive industries exists. Dissatisfaction

⁵ See Fn. 4.

⁶ See also G7 (2016), pledging to remove support for fossil fuels by 2025.

⁷ Funds raised would have supported social and environmental development programs and the promotion of domestic renewable energy.

over its insufficient solutions-orientation and ineffectiveness in reviewing and addressing adverse impacts of response measures on trade-led development priorities (FCCC/SB/2018/INF.4) suggests that the improved forum on 'response measures' has yet to fulfil its potential.

By contrast, a continuing flow of 'brown finance' is rather easier to identify. Despite their collective stance, individual G20 countries, especially China, Japan, India and Korea, continue to finance overseas coal projects – by over \$13 bn. in 2017, a five-year high (Chen, 2018). MDBs' fossil fuel-related funding exceeded \$5bn in 2016 (Wright et al., 2018). Apart from the WBG, Wright et al. (2018) found only two MDBs specifying strict conditions on coal mining in their policies; others had no exclusions.

More positive has been the WBG's new partnership with Canada and the International Trade Union Confederation (ITUC) to provide analysis and support for developing countries' 'just transition' from coal. The World Bank, among others, also assists countries' subsidy reform efforts. On this, the IMF has the capability to include reform as a condition for lending. The GSI's targeted support to countries implementing reforms is also significant (Lemphers et al., 2018).

Overall, improvements in support offered by the World Bank for 'just transitions' from coal, and by various bodies building capacity to implement subsidy reform, need to be weighed against the ongoing limitations of the 'response measures' track and continuing flows of brown finance. There remains a significant shortfall in the delivery of this governance function.

Knowledge and learning

In terms of the need to raise awareness of 'unburnable carbon' and stranded asset risks, the IPCC 1.5 °C Special Report usefully highlighted the scale of decline in investment in extraction and conversion necessary. However, exclusion of explicit discussion of this (politically highly sensitive) aspect from the summary for policy makers reduced the potential to generate learning. Nevertheless, the request from 47 least developed countries for 'managing a phase out of fossil fuels' to be included in the Talanoa Dialogue (SEI, 2018), and the commitment from the IEA to present a 1.5°C-compatible scenario, suggests the issues are gaining traction. Similarly, the UNEP-led Production Gap report introduced a new metric to measure consistency of production levels with climate goals, raising awareness that by 2030, current plans will produce 120% more fossil fuels than would be consistent with limiting warming to 1.5C (SEI et al., 2019).

In terms of promoting learning regarding the full costs of existing development pathways and potential benefits of others, institutions including the OECD, IEA, IMF, UNEP and the WBG have usefully developed and shared relevant analyses. Knowledge sharing among governments, through both public and confidential channels, is occurring through the World Bank's Energy Sector Management Assistance Programme (ESMAP). Similarly, the Bank's Climate Action Peer Exchange convenes finance ministers to discuss FFS reform. The UNFCCC response measures 'improved forum' continues to facilitate interactive sharing of information, experiences, case studies, etc.

Overall, the delivery of this function by the existing governance complex is improving, but still falling short of the concerted effort required to shift engrained attitudes. A clearer signal from international-level institutions that the world is serious about phasing out fossil fuel production is needed before learning efforts, such as those outlined here, can make significant headway.

5. Conclusions and options for reform

5.1. Serious governance gaps

The preceding analysis has thrown into stark relief the significant and urgent need for the supply side of climate policy to be addressed through cooperative international institutions. Without this, any unilateral action by individual countries will not leave sufficient resources 'in the ground' to secure long-term temperature goals. Strong signals regarding unburnable carbon, translated into accepted rules, transparently applied, combined with support for diversification and increased awareness of the benefits of alternative development pathways, may all be regarded as high priorities. Fulfilment of some functions is more urgent, however, since others depend on them. Specifically, strong signals, particularly to financial markets, can raise awareness of the danger of stranded assets and prompt coordinated measures to deflate the apparent carbon bubble. This should facilitate efforts among elites in particularly vulnerable producer states to learn new approaches to development by which national interests can be secured more sustainably.

The analysis has also found that these governance needs, for the most part, have yet to be addressed meaningfully by existing international institutions. The UNFCCC and PA, in particular, leave troubling gaps, to a large extent reflecting political-economic factors which keep fossil fuel production largely off-limits to policy makers. Production-related incentives derive largely from market signals, not policy. It is also evident that the fragmented global climate and energy governance architecture gives rise to inconsistencies and trade-offs between different institutions' objectives, with no arbiter to manage them. Conflicting objectives may also occur within single institutions, particularly those, such as the IEA, whose remit encompasses the so-called energy 'trilemma' of decarbonisation, energy security and affordability.

Governance challenges associated with deciding what carbon should be designated 'unburnable', and managing the equity concerns and related geo-political conflicts (corresponding to rule setting and means of implementation functions), are far from being fully recognised and grappled with. While some governance functions are closer to being fulfilled, they generally relate to FFS reform. The various institutions most involved in phasing out 'inefficient' subsidies (G20, IEA, OECD) can be considered to (indirectly) target fossil fuel development in a worthwhile manner. However, most of their initiatives consist of enhancing transparency, rather than developing and implementing concrete reduction measures, and most attention has been paid to consumer, not producer subsidies. Moreover, the importance of FFS reform should be kept in perspective: as Newell and Johnstone (2018: 27) phrase it, "we might prune the branches and dead leaves with fossil fuel subsidy reform, but the trunk of the tree (or the fossil fuel economy) could remain sturdy ...".

5.2. Towards a more adequate governance response

Comprehensively addressing the governance gaps identified would require an overhaul of global political economic forces of utopian proportions. However, a number of possible reforms have potential to act in a more modest and partial way. In the following, some of these are identified, governance function by function, paying particular attention to implications for the UNFCCC and G20. It is also worth noting that the prospects for such proposals would be enhanced in many cases if heavy, well-financed lobbying activity

by fossil fuel interests in international negotiating venues could be curtailed. Here, the World Health Organisation's success in restricting tobacco industry involvement in negotiations under the Framework Convention on Tobacco Control (FCTC) may offer some inspiration (Gerasimchuk and Bacchus, 2017).

Guidance and signal

In principle, the G7 could make more explicit what many took to be a fossil-fuel phase-out commitment in 2015, with a shorter time frame. Obviously, this would require a new set of political incumbents in associated national capitals. The same could be said of the G20 more explicitly signalling FFS phase-out by a firm deadline, ideally in conjunction with a political declaration from the WTO. Further potential exists for the G20 to improve guidance and information regarding stranded asset risks to financial markets, reminding oil majors, for example, of the urgency of diversification. Engagement and global economic leadership of the G20 (whose membership usefully combines key fossil fuel producer countries with low-carbon transition leaders), would appear to be a prerequisite for safe handling of the carbon bubble. One possibility is for the Task Force on Climate Related Financial Disclosures to become permanent, and to produce regular reports (Goldthau, 2017). Exploiting the UNFCCC's still un-tapped potential to help governments articulate fossil-fuel phase-down pathways and actions could help in 'ratcheting' countries' mitigation ambition. At the very least, supply-side actions could feature more explicitly in NDC development guidelines, and as a separate category in synthesis reports (Piggot et al., 2017). Indicating more clearly that FFS reform can be part of a country's mitigation portfolio would increase the likelihood that such actions can be eligible for support, for example capacity building (Van Asselt and Kulovesi, 2017).

As noted above, the established territorial approach to accounting for emissions signals that supply-side actions (having extra-territorial effect) are not relevant. An alternative extraction-based emissions accounting framework could help monitor the alignment of fossil fuel supply with climate goals, thereby sending a more appropriate signal. Given that the development of a standardised methodology and capacity for territorial emissions accounting has been hard-won, an extraction-based system should probably be established in parallel (Piggot et al., 2017).

Rules for collective action

Despite decision-making responsibility ultimately resting with sovereign states, urgent consideration needs to be given to determining how the development benefits of fossil-fuel resources can be optimised within a 1.5°C-consistent carbon budget. Given that the timing and sequencing of supply constraints has potential to leave whole countries 'stranded', where might rules informing such momentous decision making (potentially involving compensation) legitimately be agreed?

As the central, dedicated forum for addressing climate change, the UNFCCC is well-placed, in principle, particularly with its near-universal participation (compared with other international energy or trade organisations), including both fossil fuels consuming and producing states (Van Asselt, 2014). As already noted, the PA offers a framework through which, in principle, countries could voluntarily articulate pathways away from fossil fuels. There is certainly untapped potential for the improved forum on response measures to address such questions. During the 2018 Talanoa process, the concept of a moratorium on new coal mines, potentially implemented through a 'fossil-fuel non-proliferation treaty' received some publicity (Newell and Simms, 2019). Arguably however, with the UNFCCC already over-burdened, such a treaty should be negotiated as a separate entity, with its own accounting and redistributive mechanisms, potentially linked to the GCF (ibid).

Whatever their merits, such proposals remain distant prospects. Furthermore, Ecuador's Yasuni ITT experience suggests caution regarding putative global-level compensatory mechanisms.

Given the tendency of multilateral efforts to gridlock, mini-lateral 'coalitions of the willing' could potentially move first with rules of their own. Such initiatives could become more comprehensive in coverage once the need for supply-side interventions becomes more widely appreciated. For example, a moderate export tax coordinated among the four largest (steam) coal exporters, Indonesia, Australia, South Africa and Colombia, could bring them net economic benefits, as well as reducing emissions (Richter et al., 2015). The resultant rise in traded coal prices would reduce consumption, while the billions of dollars potentially raised annually could fund structural transition in mining regions, and/or R&D. In principle at least, even OPEC members could apply a carbon tax to their exports, earmarking revenues for the GCF (Vidal, 2012) or for their own diversification efforts. In advance of more comprehensive international rules being agreed, both equity and economic efficiency rationales speak in favour of wealthy, historically polluting countries moving first to forgo the exploitation of particularly high-cost, carbon-intensive fossil fuels, such as deep-sea oilfields (Lenferna, 2018). Tying such initiatives to Paris goals would make more explicit the need for other countries to address supply issues (Piggot et al., 2017).

New multilateral rules for FFS are easier to envisage, although here too consensus on the most appropriate formulator and enforcer, or whether rules can feasibly be the subject of a dedicated multilateral agreement, has not yet emerged (Smith and Urpelainen, 2017). However, an important opportunity clearly exists for the WTO, the only body with a definition of subsidies tried and tested through vigorous negotiation. Adoption of a new multilateral agreement on subsidies or trade remedies, within the WTO framework, is conceivable, along with a range of other possibilities (Espa and Rolland, 2015).

Transparency and accountability

Regarding transparency of FFS, while several IOs and NGOs have developed their own data repositories of support measures, greater coordination could increase their policy impact (OECD, 2018), especially as inconsistencies in definitions and data have been used as excuses to postpone action. There is significant potential for the WTO to enhance transparency without changes in its legal framework (Van Asselt, 2014; Casier et al., 2014), including e.g. a new notification template providing further details on subsidies in a standardised fashion.

Means of implementation

The process by which countries and regions at risk of 'stranding' diversify along alternative development paths requires careful analysis and complex international negotiation and coordination, extending beyond conventional climate policy channels to encompass development cooperation and governance of finance. While the UNFCCC and the G20 are both strong candidates to oversee this, each would require an overhaul to be credible and legitimate leaders.

The UNFCCC's response measures forum in particular has obvious further potential to facilitate assistance with transition (FCCC/SB/2018/INF.4: page 7). Similarly, the Paris Committee on Capacity Building could expand to include tools and support for more supply-focused actions (Piggot et al., 2017). In time, the GCF and GEF could become more active in channelling transition-related funds as part of their wider finance role. In principle this could be connected to fund-raising mechanisms mentioned in the discussion of rules for collective action, above, agreed by the UNFCCC or elsewhere. More realistically in the short term, rules to

restrict FFS, potentially set in other venues, could free up large funds to finance such transitions (Merrill et al., 2017).

Given its role facilitating cooperation on climate-related financial risk and green finance, the G20 could encourage dialogue between its own members (and potentially other key donors), MDBs and international organisations, and developing countries, with the objective of better coordinating development assistance to producer states embarking on transition (Bradley et al., 2018; Goldthau, 2017). 'Non-traditional' donors will need to be engaged, including emerging economies and their export-import banks, OPEC, Arab and Islamic development banks, as well as philanthropic trusts and export credit agencies. Sovereign wealth funds have been underutilized as sources of capital, but may be possible to mobilise in a more coordinated way to boost investment in non-extractive sectors. Without such wide-ranging participation, assistance from different actors may support conflicting development models (Bradley et al., 2018).

Knowledge and learning

Although not featuring in current negotiations, the PA's Global Stocktake could in principle include an assessment of fossil fuel supply, in relation to temperature goals. Arguably, seizing this opportunity is a matter of urgency (Piggot et al., 2017). The concepts of un-burnable carbon and stranded asset risks need to become much more widely discussed in development policy fora and processes at UN level, including SDGs, UNEP Green Economy & Finance Initiatives, donor forums such as OECD, Sustainable Energy for All, etc. Awareness-raising by the International Labour Organisation (ILO, 2015) and international trade unions, already under-way, has potential to go much further (ITUC, 2015).

Greater recognition for countries' supply-side actions through UNFCCC institutions would serve to enable debate and discussion about whether such commitments are fair and ambitious, and reduce chances of policy reversal (Piggot et al., 2017). Greater recognition of supply-side aspects in the NAZCA portal could encourage further efforts by non-state/non-Party actors. For example, BP has announced a scaling back of exploration and willingness to leave some assets unrecovered (Holder, 2019).

To begin more serious discussion within the fossil-fuel sectoral system itself, a project task force in the *OECD Policy Dialogue on Natural Resource-based Development* could offer a suitable forum for evidence-based deliberations and formulation of recommendations (Schlösser et al., 2017). Awareness could be improved if transboundary impact assessment of large-scale energy related projects, explicitly integrating previously unrecognized social-environmental impacts and injustices, were made mandatory at global level (Healy et al., 2019).

5.3. Outlook

This paper has noted how restricting the international supply of fossil fuels is increasingly acknowledged to be necessary if long-term global temperature goals are to be achieved, but how immense barriers to imposing such restrictions remain. In theory, a managed decline in supply could be facilitated by international cooperation, through a range of currently existing or proposed new institutions. In practice, however, despite some rhetorical commitments, in the face of concerns over fiscal stability, equity, and geo-political tensions, adequate international institutional responses have not been forthcoming.

Nevertheless, as impacts visibly worsen, as fossil fuel market volatility likely increases, and as shifts in public opinion allow key governments to think more boldly, more radical proposals for international cooperation, of the kind highlighted in this article, may begin to receive a fairer hearing. The UN Secretary General's

declaration in November 2019 that 'we simply have to stop digging and drilling' (Reuters, 2019) testifies to a shift in policy discourse, and gives it significant further impetus at an international as well as national level. Future research can fruitfully examine further how principles of just transition away from fossil-fuel dependence could be, and are, being elaborated and institutionalised in a new, multi-level political context.

Declaration of competing interest

The author declares that he has no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

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